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10/823,282	04/12/2004	John Erik Lindholm	NVDA P000735	4571

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EXAMINER	
HSU, JONI	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/823,282	LINDHOLM ET AL.	
	Examiner	Art Unit	
	Joni Hsu	2628	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *18 April 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-25* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-3* is/are rejected.

7)☒ Claim(s) *4-25* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

1. Applicant's arguments, see pages 8-9, filed April 18, 2007, with respect to the 35 U.S.C. 101 rejections and to Claims 4-25 have been fully considered and are persuasive. The 35 U.S.C. 101 rejections of Claims 1-16 and the 35 U.S.C. 103(a) rejections of Claims 4-25 have been withdrawn.

2. Applicant's arguments with respect to claims 1-3 have been considered but are moot in view of the new ground(s) of rejection.

3. Applicant's arguments, see pages 8-10, filed April 18, 2007, with respect to the rejection(s) of claim(s) 1-3 under 35 U.S.C. 103(a) have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of Allen (US006825843B2).

4. Applicant argues that Guttag (US006173394B1) does not teach that this instruction is applied to only selected samples of a group of samples. Guttag also does not teach that the samples are dispatched together with a token associated with the selected samples into the pipeline (pages 8-9).

In reply, the Examiner agrees. However, new grounds of rejection are made in view of Allen.

5. Applicant argues that the teaching of Lueh (US006966057B2) that state data associated with samples which are not to be executed is pushed onto a stack for later retrieval is inconsistent with the teachings of Guttag. There is no need in Guttag's construct to save global state data on a stack and then restore it. As taught in Guttag, a delay in operations of the sequence is accepted, while necessary instructions are fetched, as opposed to recycling selected samples within the pipeline disclosed in the present application (page 9).

In reply, the Examiner agrees. However, new grounds of rejection are made in view of Allen.

6. Applicant argues that Gossett (US006236413B) teaches that the system disclosed does not have any branching capability. Therefore, Gossett cannot operate in a way where selected samples are processed using a particular instruction, while the remaining samples are not subject to execution of that instruction. Later, when the operations on the first sample has been executed, then processing of all samples pursuant to the instructions resumes. There is no teaching in Gossett that a token is dispatched with the pass of the group of related samples through the pipeline (pages 9-10).

In reply, the Examiner agrees. However, new grounds of rejection are made in view of Allen.

Claim Objections

7. Claims 1, 9, and 22 are objected to because of the following informalities: Claims 1, 9, and 22 recite "...configuring each of a plurality of **a** programmable computation units..." where it should recite "...configuring each of a plurality of programmable computation units...". Appropriate correction is required.

8. Claim 4 is objected to because of the following informalities: Claim 4 recites "a second call instruction**s**" where it should recite "a second call instruction". Appropriate correction is required.

9. Claim 9 is objected to because of the following informalities: Claim 9 recites "...dispatching a token...along with all the group of samples executing operations specified in first return instructions on the first sample..." where it should recite "...dispatching a token...along with all the group of samples**;** executing operations specified in first return instructions on the first sample...". Appropriate correction is required.

10. Claim 11 is objected to because of the following informalities: Claim 11 recites "The method of claim, wherein...". It does not specify the claim number for which Claim 11 depends from. Claim 11 previously depended from Claim 9, and therefore it is assumed that Claim 11 still depends from Claim 9. Appropriate correction is required.

11. Claim 17 is objected to because of the following informalities: Claim 17 is directed to a system, however, it includes the limitation "...the system comprising: **configuring** each of a plurality of programmable computation units by a field of codeswords to perform an operation on multiple samples of the groups...". This "configuring" limitation is a method step and is not a system component. The claim cannot be directed to both a system and a method. Therefore, this limitation should be rewritten so that it is directed to a system component. For example, this limitation could be rewritten to instead recite "...the system comprising: a plurality of programmable computation units, each of the plurality of programmable computation units configured by a field of codewords to perform on operation on multiple samples of the groups...".

Claim 17 also recites "...codeswords..." where it should recite "codewords".

Claim 17 also recites "...a subroutine depth scoreboard configured to store a subroutine depth corresponding to each sample of the groups of related samples *of the*; a global..." where it should recite "...a subroutine depth scoreboard configured to store a subroutine depth corresponding to each sample of the groups of related samples; a global...". Appropriate correction is required.

12. Claim 22 is objected to because of the following informalities: Claim 22 recites "...configuring...multiple samples of the groups means for incrementing..." where it should recite "...configuring... multiple samples of the groups; means for incrementing...". Appropriate correction is required.

Claim Rejections - 35 USC § 103

13. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

14. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

15. Claim 1 is rejected under 35 U.S.C. 103(a) as being unpatentable over Allen (US006825843B2) in view of Lueh (US006966057B2).

Allen discloses a method for processing a group of related divergent graphics samples in a programmable graphics processing unit having a recirculating pipeline (200), the method comprising configuring each of a plurality of programmable computation units (260, 270) by a field of codewords to perform an operation on multiple samples, incrementing a subroutine depth of a first sample of the related divergent samples to designate that a first call instruction and a first return instruction are to be executed on the first sample (D1); defining the second sample of the related divergent samples as idle so that the first call and the first return instructions are not

to be executed on the second sample; dispatching a token associated with the group of samples into the pipeline along with all samples in the group of related divergent samples, executing the first call instruction and the first return instruction on the first sample, but not the second sample (*outputs the first PC token followed by selected fragments D1, where D1 represents a set of fragments selected from a total number of fragments, program instructions can be executed using shader back end 260 and combiners 270, while the fragments in fragment set D1 are being processed by recirculating shader pipeline 200, postpone creation of the second PC token until after fragment set D1 is processed, when the first PC token returns, remap 250 outputs the second PC token*, Col. 7, lines 10-34; *increment the current PC for each program instruction that is executed by codewords in a PC token*, Col. 9, lines 23-26); and storing the processed divergent samples for output or display (*these data are written from raster analyzer 165 to local memory 140, when processing is completed, an output 185 of graphics subsystem 110 is provided using an output controller 180, output controller 180 is configured to deliver data to a display device*, Col. 4, lines 34-42).

However, Allen does not teach that the pipeline is implemented as a single instruction multiple data (SIMD) architecture, and that defining the second sample as idle includes pushing state data of a second sample upon which the first call instructions are not to be executed. However, Lueh discloses having a pipeline implemented as a single instruction multiple data (SIMD) architecture (Col. 2, lines 28-34), and pushing state data of a second sample upon which the first call instructions are not to be executed onto a global stack to define the second sample as idle (*saving the live global state includes pushing the live global state onto a stack, and restoring the saved live global state includes retrieving it from the stack*, Col. 9, lines 4-35).

It would have been obvious to one of ordinary skill in the art at the time of invention by applicant to modify the device of Allen so that the pipeline is implemented as a single instruction multiple data (SIMD) architecture, and that defining the second sample as idle includes pushing state data of a second sample upon which the first call instructions are not to be executed as suggested by Lueh. Lueh describes that SIMD is a well-known type of computer architecture (Col. 2, lines 28-34). Lueh discloses that executing a global stack prevents the call instructions from being executed (Col. 9, lines 22-33). This prevents a field watch sequence involves this pushing of state data onto a global stack, and pushing state data onto significant runtime overhead caused by un-activated call instructions because it guards the execution of the instruction (Col. 7, lines 9-16). Therefore, pushing state data onto a global stack guards call instructions that are not needed from being executed, and therefore prevents significant runtime overhead caused by un-activated call instructions.

16. Claims 2 and 3 are rejected under 35 U.S.C. 103(a) as being unpatentable over Allen (US006825843B2) and Lueh (US006966057B2) in view of Kiriansky (US 20040133777A1).

17. With regard to Claim 2, Allen and Lueh are relied upon for the teachings as discussed above relative to Claim 1. Allen discloses the step of holding the second sample idle (*postpone creation of the second PC token until after fragment set D1 is processed*, Col. 7, lines 28-29) and associating a sample depth in a sample depth score board with the first sample and each sample of the group of related samples (D1), wherein the sample depth represent which call/return cycle is being executed on each of the samples (*current program counter, indicating the program*

instruction that is being executed, is stored in the program counter unit, likewise, the current loop count, indicating the loop iteration that is being executed, is stored in the loop count unit, Col. 2, lines 10-22; *first PC token followed by selected fragments D1*, Col. 7, lines 10-14).

However, Allen and Lueh do not teach that the sample depth represents the number of all/return cycles **to be** executed. However, Kiriansky discloses a pipeline implemented as a SIMD architecture [0112] and associating a sample depth in a sample depth score board wherein the sample depth represents the number of call/return cycles to be executed (*function calls follow a fixed protocol where a return value is saved on the runtime stack so that when the function ends it can get back to where it came from*, [0292], *store the call depth*, [0312], [0313]).

It would have been obvious to one of ordinary skill in the art at the time of invention by applicant to modify the devices of Allen and Lueh so that the sample depth represents the number of all/return cycles to be executed as suggested by Kiriansky because Kiriansky suggests the advantage of only performing an operation if the number of call/return cycles is large in order to reduce the amount of processing [0313].

18. With regard to Claim 3, Allen does not teach that holding the second sample idle comprises encoding the second sample with non-operation information and pushing the second sample onto the global stack encoded with information that no operations are to be performed on the second sample, removing the second sample from the group of divergent samples on which operations are performed. However, Lueh discloses that holding the second sample idle comprises encoding the second sample with non-operation information (*replace the jump instruction with a no-op sequence*, Col. 9, lines 4-35) and pushing the second sample onto the

global stack encoded with information that no operations are to be performed on the second sample, removing the second sample from the group of divergent samples on which operations are performed (Col. 9, lines 4-35).

It would have been obvious to one of ordinary skill in the art at the time of invention by applicant to modify the device of Allen so that holding the second sample idle comprises encoding the second sample with non-operation information as suggested by Lueh. Lueh discloses that by encoding the sample with non-operation information, this implements the guard to prevent execution of the code (Col. 9, lines 4-13). This prevents significant runtime overhead caused by un-activated call instructions because it guards the execution of the instruction (Col. 7, lines 9-16). Therefore, encoding the sample with non-operation information guards call instructions that are not needed from being executed, and therefore prevents significant runtime overhead caused by un-activated call instructions. It would have been obvious to modify the device of Allen to include pushing the second sample onto the global stack encoded with information that no operations are to be performed on the second sample, removing the second sample from the group of divergent samples on which operations are performed for the same reasons given in the rejection for Claim 1.

Allowable Subject Matter

19. Claims 4-25 are objected to as being dependent upon a rejected or objected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Joni Hsu whose telephone number is 571-272-7785. The examiner can normally be reached on M-F 8am-5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ulka Chauhan can be reached on 571-272-7782. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

JH

KEE M. TUNG
SUPERVISORY PATENT EXAMINER